Fermi National Accelerator Laboratory
Batavia, IL 60510

CMS ME3/1 ANODE PANEL WIRE WINDING TRAVELER

Reference Drawing(s)

Endcap Muon Chamber ME3/1 Final Assy
5520-ME-368310

Endcap Muon Chamber ME3/1 Anode Panel Assy
5220-ME-368311

Budget Code: **Project Code:**

Released by: **Date:**

Prepared by: B. Jensen, M. Hubbard, L. Lee

Title	Signature	Date
TD / E&F Process Engineering	**Bob Jensen/Designee**	
TD / E&F Assembly	**Glenn Smith/Designee**	
TD / E&F Technological Physicist	**Oleg Prokofiev/Designee**	
TD / CMS Project Manager	**Giorgio Apollinari/Designee**	

Revision Page

Revision	Step No.	Revision Description	TRR No.	Date
None	N/A	Initial Release	N/A	04/26/00

Ensure appropriate memos and specific instructions are placed with the traveler before issuing the sub traveler binder to production.

1.0 General Notes

1.1 White (Lint Free) Gloves (Fermi stock 2250-1800) or Nitrile Gloves (Fermi stock 2250-2040) or equivalent shall be worn by all personnel, as required, when handling all product parts after the parts have been prepared/cleaned.

1.2 All steps that require a sign-off shall include the Technician/Inspectors first initial and full last name.

1.3 No erasures or white out will be permitted to any documentation. All incorrectly entered data shall be corrected by placing a single line through the error, initial and date the error before adding the correct data.

1.4 All Discrepancy Reports issued shall be recorded in the left margin next to the applicable step.

1.5 All personnel performing steps in this traveler must have documented training for this traveler and associated operating procedures.

1.6 Personnel shall perform all tasks in accordance with current applicable ES&H guidelines and those specified within the step.

1.7 Cover the panel/chamber, as required, with Mylar or approved material when not being serviced or assembled.

1.8 Never hand pass anything over a panel, damage could occur.

2.0 Parts Kit List

2.1 Attach the completed Parts Kit List for the CMS ME3/1 Panel Wire Winding to this traveler. Ensure that the serial number on the Parts Kit List matches the serial number of this traveler. Verify that the Parts Kit received is complete.

_____ _____

Process Engineering/Designee Date

3.0 Panel Acquisition

Completed

3.1 Acquire the Anode (ME-368311) panel as per the serial number listed in the footer, right side of this traveler. ❒

3.2 Visually check the panel for damage which is to include but not limited to scratches/gouges in the copper, damage to the sides and/or corners. ❒

Technician(s) _____ Date _____

4.0 Panel Tooling Installation

4.1 Install onto the Anode Panel the following Anode Panel Support Assembly tooling per dwg MD-368823.

Note(s):

Ensure that the screws holding the notched brackets are inserted into the panel from the side opposite to the strips (side opposite to the serial number).

Narrow End Part No.	Description	Qty
MB-368825	Trunion Bracket S.E.	1 ea
MA-368828	Notched Bracket Plate,-RT	2 ea
MA-368827	Notched Bracket Plate-LT	2 ea
MA-368826	Bracket Plate	4 ea
MA-368829	Centering Sleeve	4 ea
MA-368830	Bracket Nut	4 ea
N/A	M5x0.8x12 Flat Head Screw	8 ea
N/A	M5x0.8x25 Flat Cap Screw	4 ea
N/A	M6x1.0x20 Flat Head Screw	4 ea
MA-368813	Trunion Assembly	1 ea

Wide End Part No.	Description	Qty
MB-368824	Trunion Bracket, L.E.	1 ea
MA-368826	Bracket Plate	8 ea
MA-368830	Bracket Nut	4 ea
N/A	M5x0.8x12 Flat Head Screw	8 ea
N/A	M5x0.8x25 Flat head Screw	4 ea
N/A	M6x1.0x20 Flat Head Screw	4 ea
MA-368829	Centering Sleeve	4 ea
MA-368813	Trunion Assembly	1 ea

_____ _____

Technician(s) Date

4.2 Install the panel onto the Panel Transport Cart Assembly (MD-368810)

_____ _____

Technician(s) Date

4.3 Install onto the panel the following Anode Panel Wire Winding Guide Tooling per dwg MD-368580.

Top View of Panel

Narrow End Part Number	Description	Qty
MA-368981	Bar	2 ea
MA-368982	Plate	2 ea
MA-368983	Plate	2 ea
N/A	M5x0.8x10 Socket HD Screw	
N/A	M4x0.7x10 Flat HD Screw	
N/A	M5 Flat Regular Washer	

Wide End Part Number	Description	Qty
MA-368974	Plate	2 ea
MA-368975	Bar	2 ea
MA-368976	Plate	2 ea
N/A	M5x0.8x10 Socket HD Screw	
N/A	M4x0.7x10 Flat HD Screw	
N/A	M5 Flat Regular Washer	

Technician(s) _____ Date _____

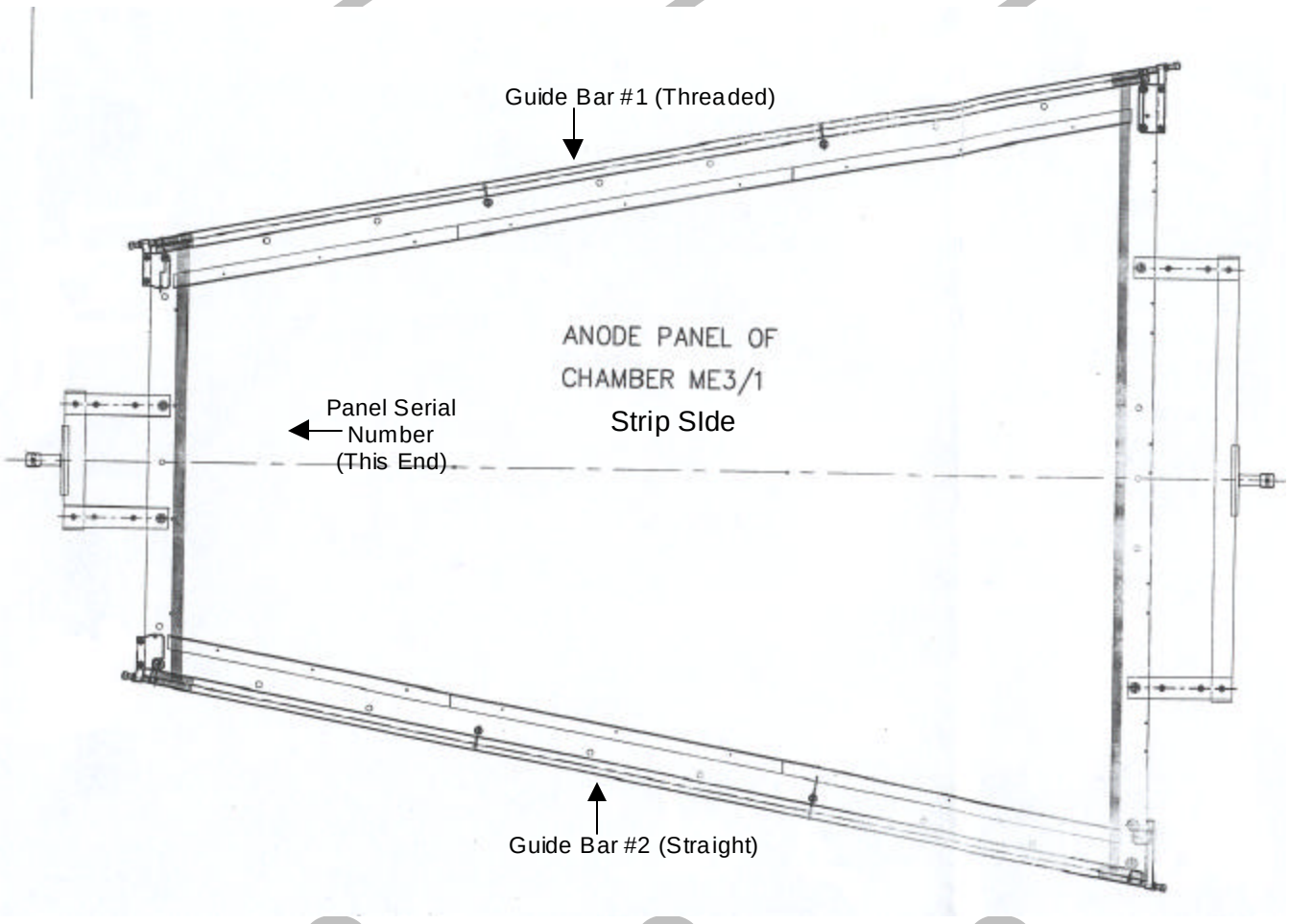
Completed

4.4 Install the Wire Guide Bar Type 2 (Straight) and tooling onto the panel per dwg MD-368580. **Do not tighten** any of the screws holding the Wire Guide on the panel side through the Insert (part # 368979). ❒

Note(s):

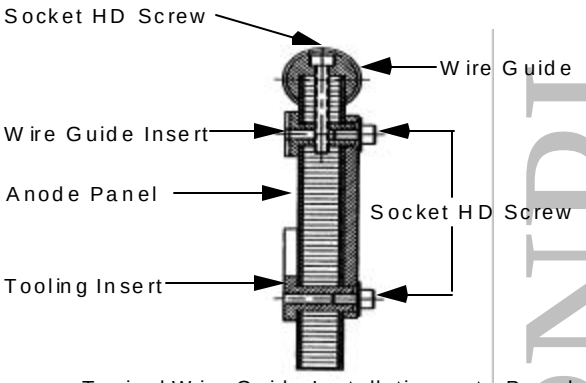
When installing the Wire Guides, ensure that that the Guide Bar Type 1 (Threaded) is located on the edge near the serial number.

4.5 Install the Wire Guide Type 1 (Threaded Bar) and tooling onto the panel as following per dwg MD-368580. **Do not tighten** any of the screws holding the Wire Guide on the panel side through the Insert (part # 368979). ❒



Completed ❒

4.6 During the installation of part # 368979, make holes through the panel honeycomb in the 8 locations along the Wire Guides where parts 368979 will be mounted.



Typical Wire Guide Installation onto Panel
Wide End Shown

Guide Bar Part Number	Description	Qty
MA-368279	Guide Bar Type 1 (Threaded)	1 ea
MA-368581	Guide Bar Type 2 (Straight)	1 ea
MA-368979	Insert	8 ea
N/A	M4x0.7x35 Socket HD Screw	12 ea
Blank		
Blank		

Technician(s) _____ Date _____

5.0 Wire Guides Alignment Procedure

Completed

5.1 Use 3 strands of 50µm line approximately 6 feet (2 meters) long with a small weight at the both ends and place them on the pad with the cross mark (typically the 3rd pad) on the wire fixation bars (pad closest to the narrow side of the chamber). Adjust the position of the Wire Guides using the M5 screw in assemblies 368812 to locate the 3 wires approximately in the center of the appropriate pads. Ideally the wire must fall on the center of the pad. Variations of +/- 30 mils are acceptable. ❒

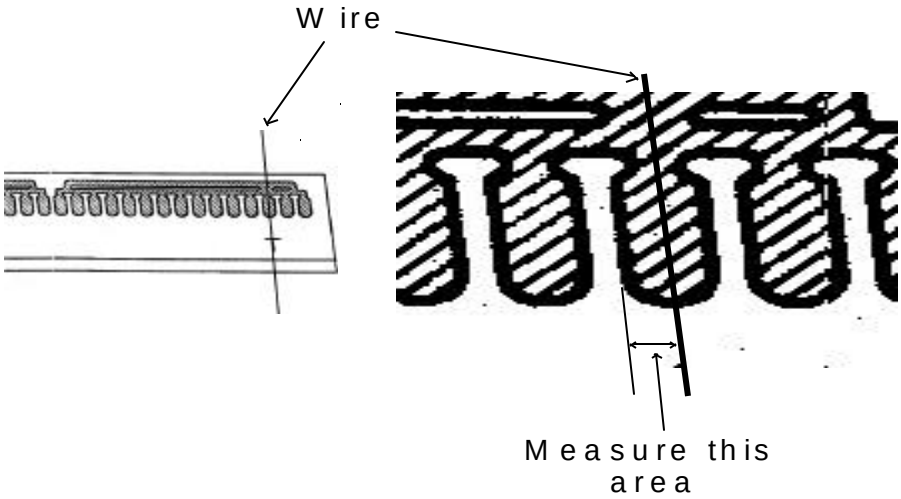
5.2 Tighten up all the screws locating the Wire Guides. ❒

5.3 Rotate the panel on the panel cart. PERFORM ONLY A CHECK that the wires are centered on the first and last pads of each wire fixation bar on the other side. If Wire Guides need to be moved at this time, a new compromise with the first side needs to be found. ❒

5.4 With an eyepiece, measure and record the distances from the wires to the edges of the pads, performing the measurement like shown in the figure below. ❒

Note(s):

Always take the measurement closer to the wide end of the panel.



Strip Side	Straight Wire Guide Side	Threaded Wire Guide Side
Wire Bar 1 (Narrow End)		
Wire Bar 2		
Wire Bar 3(Wide End)		

Non-Strip Side	Straight Wire Guide Side	Threaded Wire Guide Side
Wire Bar 1 (Narrow End)		
Wire Bar 2		
Wire Bar 3(Wide End)		

6.0 200 µm Wire Installation

Completed

6.1 Place the panel on the assembly table, panel strip side facing up. ❒

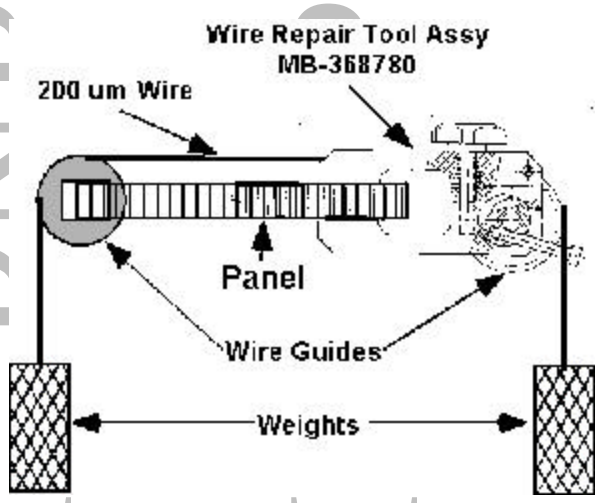
6.2 Acquire the 200 µm gold plated Cu-Be wire (dwg 368047). Record the proper information below. ❒

Lot No#	
Spool Footage	
Wire Size	
Spool Weight	
Date of Mfg	

6.3 Handling the wire with White (Lint Free) Gloves, cut 1 piece approximately 150 cm (6 feet) long. Secure the ends of the wire to two 500 grams weights. ❒

6.4 Locate the wire on the wire fixation bars. Make sure the wire is located close to the cross-mark on the wire fixation bar. A variation of +/- 30 mils is acceptable. ❒

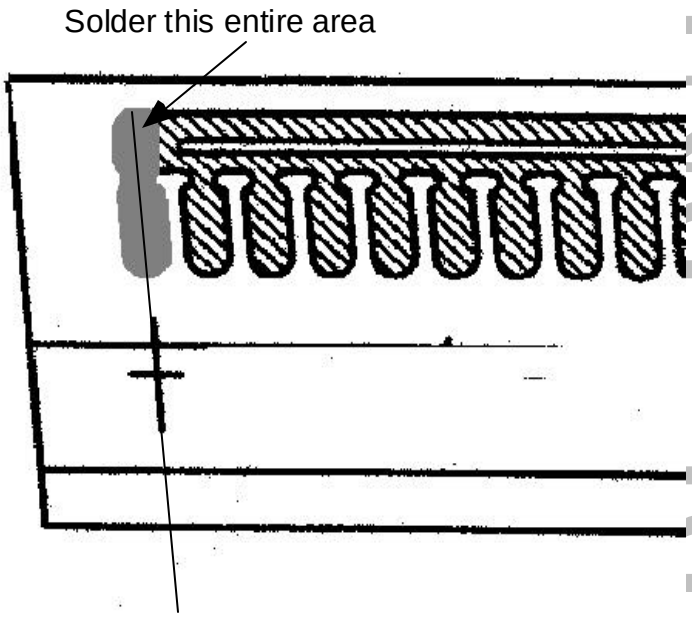
6.5 Allow one of the two weights to hang off the panel at a 45° angle through a pulley. ❒



6.6 Solder the 200 µm wire to the wire fixation bar using Almit Solder (MA-368291) ❒
Use the complete length of the pad to apply the solder according to dwg below

Note(s):

Ensure to solder only the area that is shaded in the dwg below.



Note(s):

Ensure the solder joint surface is smooth to the touch and shiny.

6.7 Break off the excess wire and remove the weight. ❒

6.8 Clean the wire with Ethyl Alcohol (Fermi Stk. No. 1920-0600) and a low-lint wipe (Fermi Stk. No. 1660-2500). ❒

Completed ❒

6.9 Clean the soldering pad that has the 200µm wire attached with Ethyl Alcohol (Fermi Stk. No. 1920-0600) and low lint wipes (Fermi Stk. No. 1660-2500) to remove flux and any other dusts, dirt, oils, or foreign material.

Note(s):

Ensure all used alcohol wipes are disposed of in the Red Safety Can as Special Waste.

6.10 Repeat steps 6.3 through 6.10 until a total of six (6) wires are soldered on and as each wire is completed check it off in the box below

Wire Number Strip Side	Completed

6.11 Rotate the panel on the Soldering table and perform Steps 6.3 through 6.10.

Wire Number Non-Strip Side	Completed

_____ _____

Technician(s) Date

7.0 Panel Wire Winding Set-Up

Completed

Note(s):

The following checks are performed with no wire mounted on the winding machine.

7.1 Plug in the electrical line cord. ❒

7.2 House air should be connected at all times, and set the Wire Winding Machine tension gauge to 260 GRAMS. ❒

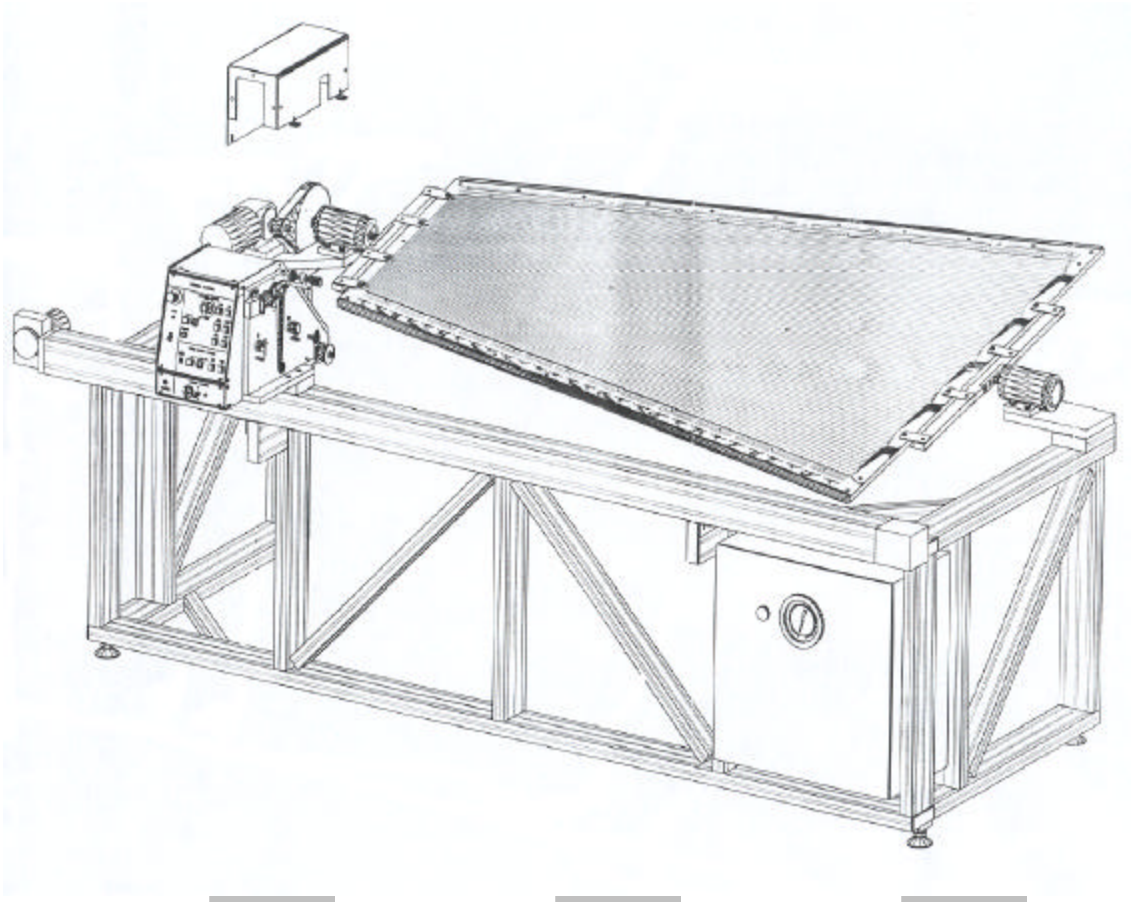
7.3 Ensure the panel is mounted with the narrow end close to the panel driving motor, the threaded comb on top and the strip side facing the operator (or indexing head) ❒

7.4 Ensure the panel is supported properly on the turning mechanism and the panel support tooling is fully engaged into the turning mechanism. ❒

7.5 Clean the entire panel with Ethyl Alcohol (Fermi Stk. No. #1920-060000) and Texwipe TX325 (3" X 2.5") Natural Wipes (McMaster-Carr) to remove any dirts, dusts, oils, and other foreign material on the panel. ❒

7.6 Ensure all equipment is removed from the area in which the panel will rotate. ❒

7.7 Turn on the Wire Winding Tensioner. Refer to Panel Wire Winding Machine OP-368900. ❒



Completed

7.7 Bring the winding head past the left edge of the tape marker located winding head guide. Reverse the direction of motion on the dispensing head. Set the head velocity to 1. Set the indexer to Run. ❒

7.8 Down-load in the machine controller the appropriate number of indexing counts through the following procedure:

7.8.1 Open the panel housing the machine controls ❒

7.8.2 Toggle the switch to the position needed for the panel under winding (up for 10 degree chamber, down for 20 degree chamber). ❒

7.8.3 Push the red downloading button once. ❒

7.8.4 Toggle the switch back to the neutral position. ❒

7.8.5 Close and secure the panel housing the machine controls. ❒

7.9 Turn on the glass scale read-out and zero it. Start the panel for 10-15 rotations at 50% of speed checking the following items: ❒

7.9.1 Wire Dispensing head indexing on the threaded comb. ❒

7.9.2 Indexing amount, as displayed by the glass scale, corresponding to 124.47 mils for a 10 degree chamber and to 122.81 mils for a 20 degree chamber. The best way to perform these measurements is to read the indexing amount over 10 steps, to achieve a reading of 1.2447 inches and 1.2281 inches respectively. Record the read-out. ❒

Indexing on Threaded Comb	
First 10 Step Average Index	

7.10 In case the head indexes by an amount different than 124.45 mils on the first step, stop and reverse the panel rotation, go back to the starting position (left edge of the tape marker) and restart ❒

7.11 Stop the panel rotation and reverse it until the indexer head is to the right edge of the tape marker. Bring the panel in the vertical position, with the threaded comb on top and the strip facing the operator. ❒

_____ _____

Technician(s) Date

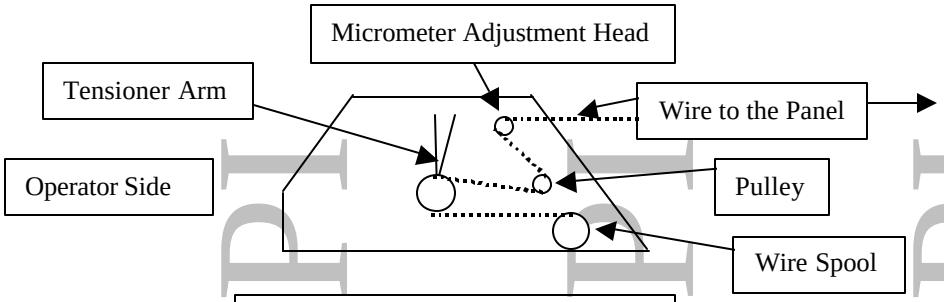
8.0 Panel Wire Winding

Completed

8.1 Acquire the proper gold plated tungsten wire (MA-369019) required to wire wind this panel and record the appropriate information below. ❒

Lot No#	
Spool Footage	
Wire Size	
Spool Weight	
Date of Mfg	

8.2 Ensure the head is located at the start point, and install the wire spool (MA-368019) onto the wire winding spool tensioner and spool the wire through the tensioner. ❒



Side View of Control Console for Wire Winding Machine

8.3 Set the Micro Adjustment Head to its starting point (.001). ❒

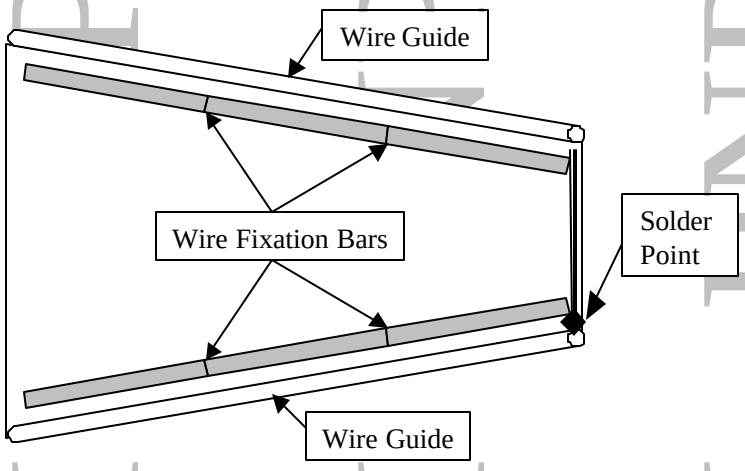
_____ _____

Technician(s) Date

Completed

8.4 After spooling through the wire tensioner, tape the end of the wire to the panel. Turn ON panel rotation and start winding the panel 10 full turns without indexing to to allow the wire to overlap. ❒

8.4.1 Solder the group of 10 wires together at the bottom edge of one side of the panel between the comb and the Wire Fixation Bar. ❒



8.4.2 Rotate the panel 180° and solder the group of 10 wires at the bottom edge of the other side of the panel between the comb and the Wire Fixation Bar. ❒

Technician(s) _____ Date _____

8.5 Panel Winding

Completed

Note(s):

Beware of all moving parts when winding the panel.

Ensure that there is nothing in the area of the rotation path of the panel before engaging.

8.5.1 Begin actual wire winding and visually check to ensure the placement of the wire into the slots on the Wire Guides. Record panel wire winding start date and start time below. ❒

	Date	**Time**
Panel Start		

8.5.2 When the wire has been wound to complete the first full turn, CHECK to ensure the wire is centered on both sides of the panel on the first pad. ❒

8.5.3 Make one or two complete turns, STOP and re-check to ensure the wire is centered on the solder strip pad. During the balance of the panel winding, visually check to ensure the wire is being wound on center of the solder pads. If not adjust the wire placement by adjusting the micrometer mounted on the Winding Machine Head. ❒

8.5.4 During the first winds, when the Wire Guide engages the wires, check that the wire gets to the center of the Wire Guide groove. If necessary adjust the position of the wire through the micrometer mounted on the Winding Machine Head. ❒

8.5.5 Zero the Glass Scale read-out. ❒

8.6 Record the Paddle Rate from the Wire Console Panel in the below box.

Note(s):

The maximum allowed paddle rate is 65%.

Paddle Rate	

8.7 During the course of winding the panel, if a change of wire spool is required, record the following information on the spool below. Note in Step #5.6, with a designation of 'C' and an appropriate sequence number (i.e., C1 is first wire change) where a wire spool change occurred.

	Spool Change #2	Spool Change #3
Lot No#		
Spool Footage		
Wire Size		
Date of Mfg		

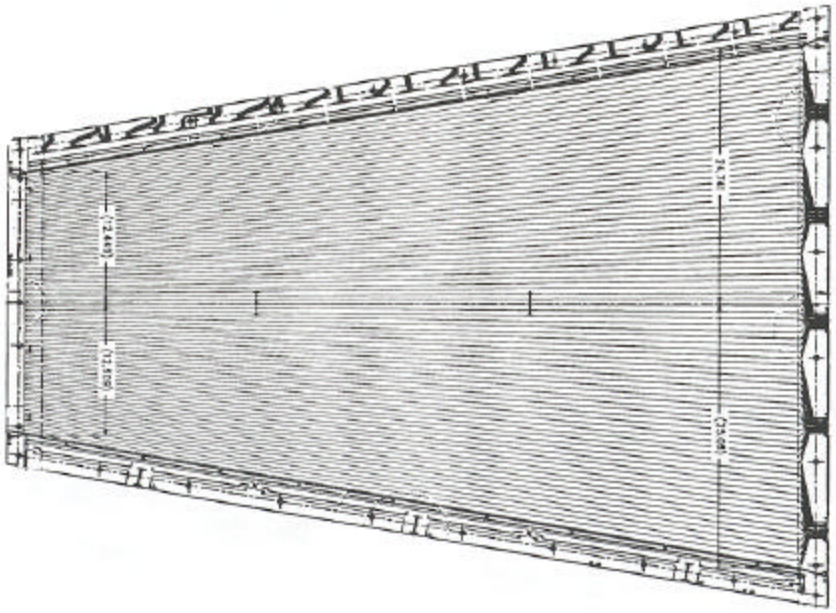
Technician(s) Date

Completed ❒

8.8 During the course of the winding of the panel, record below areas where wire 'skips' occurred by numbers and number of 'back-tracking' turns required to access an adequate starting point. Use the designation of 'S' for skips (i.e., S1 is for Skip #1). If a wire break occurs, indicate the break also below, using the designation of 'B' for break (i.e., B1 is for Break #1).

Note(s):

When a Skip or Break occurs, 'back-track' by 10 complete turns before starting the winding process again.



SKIPS	'Back-Tracking Turns
Skip #1	
Skip #2	
Skip #3	
Skip #4	
Skip #5	

BREAKS	'Back-Tracking Turns
Break #1	
Break #2	
Break #3	
Break #4	
Break #5	

Note(s):

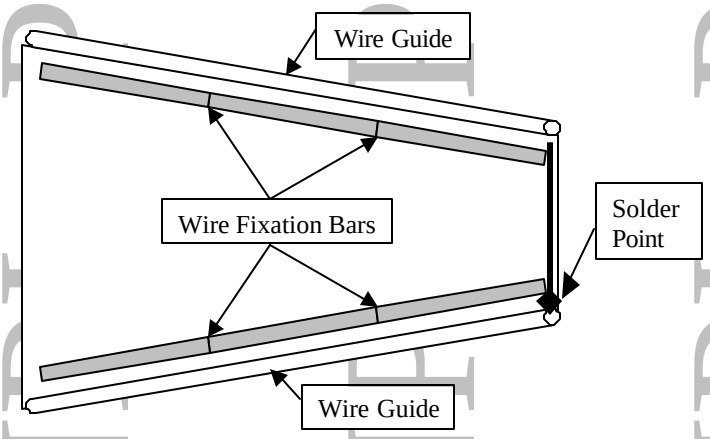
DO NOT touch the wire after winding is complete!

8.9 After completing the full wire winding on the panel, continue wire winding past the ends of the wire fixation bars a minimum of 2 full turns. ❒

8.10 Turn OFF indexing and continue wire wrapping while overlapping the wire a minimum of 10 full turns. ❒

8.11 Stop the winding process, soldering group of wires together to keep the tension. ❒

8.11.1 Solder the group of 10 wires together at the bottom edge of one side of the panel between the comb and the Wire Fixation Bar. ❒



8.11.2 Rotate the panel 180° and solder the group of 10 wires at the bottom edge of the other side of the panel between the comb and the Wire Fixation Bar. ❒

Note(s):

When soldering the wires together, DO NOT SOLDER to the solder pad on the wire fixation bar.

_____ _____

Technician(s) Date

Completed

8.12 Secure the wire to the panel using masking tape. Shut off the wire tensioner, cut the wire and properly secure the wire end to the spool ❒

8.13 Remove the Wire Spool from the Wire Winding Machine and place the spool into a plastic zip-lock bag ensuring the bag and spool are properly identifiable. Weigh the wire spool at the end of winding. Record the weight on a label affixed to the bag. ❒

8.14 Record panel wire winding finish date and finish time below.

	Date	**Time**
Panel Finish		

8.15 Record the Glass-scale readout

Glass scale Readout	

Technician(s) _____ Date _____

9.0 Production Complete

XXX 9.1 Process Engineering verify that the CMS Anode Panel Wire Winding (5520-TR-333460) is accurate and complete. This shall include a review of all steps to ensure that all operations have been completed and signed off. Ensure that all Discrepancy Reports, Nonconformance Reports, Repair/Rework Forms, Deviation Index and dispositions have been reviewed by the Responsible Authority for conformance before being approved.

Comments:

_____

_____ _____

Process Engineering/Designee Date

10.0 Attach the Process Engineering "OK to Proceed" Tag on the panel.

_____ _____

Process Engineering/Designee Date

11.0 Proceed to the next major assembly operation as required.